MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2022/2023

PAM0135 – ALGEBRA

(Foundation in Information Technology)

8 JULY 2023
9.00 a.m. – 11.00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of **THREE** pages excluding the cover page.

2. Answer **ALL FIVE** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please write all your answers in the Answer Booklet provided. All necessary working steps **MUST** be shown.

Question 1 (10 marks)

a) Simplify:

i. $\dfrac{\left(x^{-2}y^3z^4\right)^{-5}}{\left(x^2z^{-1}\right)^3}$. [2 marks]

ii. $2\sqrt{108}-6\sqrt{300}-\sqrt{147}$. [2 marks]

b) Perform the indicated operations and simplify:

$6\left(x^2-y^2\right)+x\left(y-2x\right)-3y\left(4x+7y\right)$ [2 marks]

c) Rationalize the denominator: $\dfrac{24}{\sqrt{17}-3}$. [2 marks]

d) Find the remainder if $f(x)=4x^4-15x^2-4$ is divided by $x-2$ using synthetic division. [2 marks]

Question 2 (10 marks)

a) Solve the equation:

i. $\sqrt{5x+9}=x-1$. [3 marks]

ii. $5(x-7)-2(3x-4)=3x$ [2 marks]

b) Solve the inequality:

i. $\left(x^2-25\right)(3-x)\le 0$ [3 marks]

ii. $\left|\dfrac{3x}{2}-11\right|>4$. [2 marks]

Continued ...

Question 3 (10 marks)

a) Consider the function $f(x)=\frac{2x}{x+3}+5$.

i. Find the domain of $f(x)$. [1 mark]

ii. Find the value of x for which $f(x)=3$. [1.5 marks]

b) Given that the function of $f(x)=\sqrt{2x-5}$ and $g(x)=x^2-4x$. Find $(g\circ f)(x)$. Hence, evaluate $(g\circ f)(4)$. [2.5 marks]

c) Sketch the graph of $y=\frac{1}{2}|x-2|-3$. Start with the graph of parent function and show all four stages. State the intercepts in each graph. Find the domain and range of $f(x)=\frac{1}{2}|x-2|-3$. [5 marks]

Question 4 (10 marks)

a) For an arithmetic sequence: 1,–2,–5,.... Find the 90th term and the sum of the first 15 terms. [3 marks]

b) Find the sum of the first 10 terms of the sequence: $\frac{1}{4},\frac{1}{2},1,2,\ldots$. Hence, determine whether the infinite geometric series, $\frac{1}{4}+\frac{1}{2}+1+2,\ldots$ converges or diverges. [3 marks]

c) Expand the expression $\left(2x-\frac{1}{x^3}\right)^5$ by using Binomial Theorem. Hence, determine the coefficient of x. [4 marks]

Continued ...

Question 5 (10 marks)

a) Let $f(x)=\frac{3x+6}{5x-3}$. Find the inverse of $f(x)$. [3 marks]

b) By using information in a), show that $f\left(f^{-1}(x)\right)=x$. [2 marks]

c) Solve the equation $\frac{500}{20+6^{3x}}=5$. [2.5 marks]

d) Given the piece-wise defined function below,

$$f(x)=\begin{cases} x^2 & if \quad -2\le x<0 \\ x-3 & if \quad 3\le x<7 \end{cases}$$

Sketch the graph of function $f(x)$. Hence, state the intercept(s), is any.

[2.5 marks]

Keys Formulas

1. Difference and Sum of Two Cubes: $x^3 \pm a^3 = (x \pm a)(x^2 \mp ax + a^2)$
2. The quadratic formula: $x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$
3. Arithmetic Sequence: $a_n = a + (n-1)d$; $S_n = \frac{n}{2}[2a_1+(n-1)d] = \frac{n}{2}[a_1+a_n]$
4. Geometric Sequence: $a_n = ar^{n-1}$; $S_n = a\frac{1-r^n}{1-r}$; $r \neq 0,1$; $S_\infty = \frac{a}{1-r}$
5. The Binomial Theorem:
$$(a+b)^n = \binom{n}{0}a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \ldots + \binom{n}{k}a^{n-k}b^k + \ldots + \binom{n}{n}a^0b^n$$

End of Paper